DIEL HERBIVORY ON *THALASSIA* BLADES IN AND OUT OF *STEGASTES PLANIFRONS* TERRITORIES

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Abstract. (WLO) Threespot damselfish, *Stegastes planifrons*, defend territories against other herbivores during the day, which should cause diurnal herbivory within territories to be lower than in undefended areas. Herbivory should also be higher both inside and outside of territories during the day because abundant diurnal herbivorous fishes should graze more than scarce nocturnal urchins. We also hypothesized that there should be an equal amount of grazing inside and outside the damselfish territories at nighttime when the fish are not defending their territories. Herbivory was significantly greater in undefended areas than in damselfish territories during both day and night, and overall herbivory was significantly higher during the day than at night. The decreased nocturnal grazing inside *S. planifrons* territories may have resulted from neighboring *S. planifrons* keeping urchins far enough away from our territory sites during the day that urchins could not migrate in at night to graze on our experimental blades.

INTRODUCTION (WLO)

A sea-turtle grass, *Thalassia testudinum* grow in beds in the shallow water around coral reefs. Hay (1983) found that *Thalassia* is most heavily grazed between 0900 and 1300 with a gradual decrease throughout the afternoon. In our study area, the herbivores were mostly diurnal fishes, with only a few nocturnal urchins. Therefore, we expected to see more grazing on *Thalassia* during the daytime than at nighttime.

During the day, threespot damselfish, *Stegastes planifrons*, aggressively defend territories on coral reefs approximately 1 m diameter against other herbivores, both fish (Itzkowitz 1979), and urchins (Williams 1979). Abram et al. (1994) observed a trend of decreased herbivory on *Thalassia* inside damselfish territories as compared to outside. Although, it was not statistically significant, possibly due to the ability of herbivorous fish swarms to invade territories and outcompete the residential damselfish.

Since damselfish do not defend their territories at night, urchins are able to migrate in at night to graze (Shane and Zimmer 1984). Therefore, we expected to see equal nocturnal herbivory inside and outside the damselfish territories.

METHODS (WLO)

This study was conducted on 21-22 February 1995 on the west back reef close to the reef crest at Discovery Bay, Jamaica. We collected 240 ungrazed *Thalassia* blades from a bed in the Discovery Bay lagoon and cut all the blades to equal lengths of approximately 9 cm. Two bunches of 6 blades, each held by clothespins, were anchored with a bolt at each site. Five sites were inside aggressive *S. planifrons* territories and five were in areas not defended by any damselfish. All sites were within 10 m of a *Thalassia* bed. The samples were set on dead coral overgrown with algae 1-1.5 m deep. Night samples were left out between 1900-0630 and day samples were left out between 0630-1800. We quantified the herbivory on each blade by the following classes: 0%, ≤1%, 1-5%, 5-15%, 15-25%, 25-50%, and 50-75% and determined whether the herbivory was by fish or urchin. Large smooth circular bites were by fish, while smaller jagged nibblings around the edges were by urchins. The percent herbivory damage inside and outside territories during day and night was compared using G-tests, re-condensing the classes as needed to eliminate zero values.

RESULTS (CDW)

Herbivory was higher in undefended areas than in damselfish territories both during the day (G=26.156, df=4, P<0.001; Fig. 1) and at night (G=8.008, df=1, P=0.005; Fig. 2). Herbivory was also higher during the day than at night in both damselfish territories (G=14.766, df=1, P<0.001) and undefended areas (G=55.821, df=2, P<0.001).

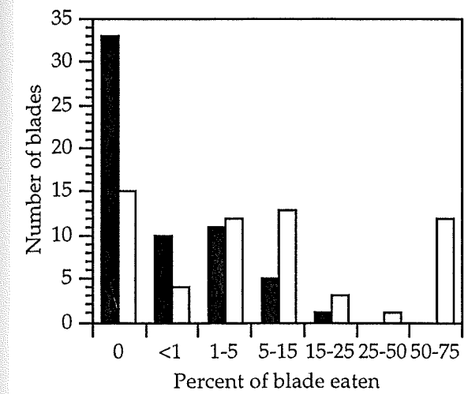

FIG. 1. Diurnal herbivory on *Thalassia* blades inside damselfish territories (black, n=60) and in undefended areas (white, n=60).

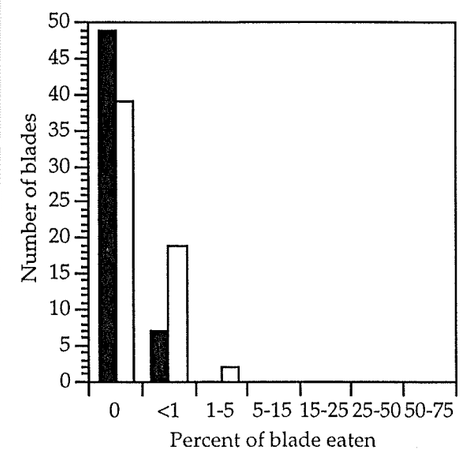

FIG. 2. Nocturnal herbivory on *Thalassia* blades inside damselfish territories (black, n=56) and in undefended areas (white, n=60).

The damselfish were only observed actively defending their territories during the day, the time at which herbivorous fish appeared most active. Almost all of the diurnal herbivory appeared to be by fishes, while the nocturnal grazing appeared to have been by urchins.

DISCUSSION (CDW)

The decreased herbivory on *Thalassia* within damselfish territories shows that active exclusion of herbivorous fishes by *S. planifrons* has a strong effect on the plant communities around them.

The increased herbivory during the day relative to night both inside and outside of damselfish territories also suggests that diurnal herbivores have a greater effect on plants than do nocturnal ones.

The higher nocturnal herbivory in undefended areas than within territories does not support our hypothesis that nocturnal herbivory should be equal in these two areas. This result reflects the difference in the number of instances of grazing, although almost all of the nocturnal foraging that occurred in both locations was minor (removing <1% of the blade), indicating that the magnitude of herbivory in these two areas is not dissimilar.

It is also possible that due to the high abundance of damselfish in the area we sampled, the territories we placed *Thalassia* in were surrounded by so many other territories that no urchins were close enough to migrate in at night to take advantage of our introduced resource. This may be an advantage of inhabiting a territory surrounded by conspecifics. However, further study is needed to determine if nocturnal herbivory by sea urchins is less in damselfish territories that are surrounded by other territories than in peripheral territories.

LITERATURE CITED

Abram, E. H., A. Liebert, and J. Ruel. 1994. "Differential Grazing on *Thalassia testudinum* in and out of *Stegastes planifrons*

territories." Pages 128-129 *in* Julie Bykowski, editor. Dartmouth Tropical Biology.

Hay, M. E., T. Collrun, and D. Dawning. 1983. "Spatial and temporal patterns in herbivory on a Caribbean fringing reef: the effects of plant distribution." Oecologia 58: 299-308.

Itkzkowitz, Murray. 1979. "Territorial tactics and habitat quality." American Naturalist 114: No. 4 *in* Abram et al. 1994.

Larson, D. M., P. Woodson, and D. Zug, Jr. 1994. "Comparison of Midday and Dusk Herbivory on *Thalassia testudinum* by parrotfish (*Scaridae*)." Pages 131-131 *in* Julie Bykowski, editor. Dartmouth Tropical Biology.

Shane, L. and W. Zimmer 1984. "Interspecific agression of the threespot damselfish (*Eupomacentrus planifrons*) toward two urchin species: *Diadema antillarium* Philippi and *Tripneustes ventricosus*. Unpublished Dartmouth FSP report.

Williams, A. H. 1979. "Interference behavior and ecology of threespot damselfish (*Eupomacentrus planifrons*)." Oecologia 38: 223-230